DYMAR

1581

R.F. Power meter

www.manualsplus.com

1003212

TECHNICAL HANDBOOK

R.F. POWER METER

TYPE 1581

CONTENTS

		Page
1.	General Description	1
2.	Specification	2
3.	Operation	4
4.	Technical Description	6
5.	Alignment Procedure	8
6.	Components List	10
7.	Circuit Diagrams	17

Dymar Electronics Limited,
Colonial Way, Radlett Road,
Watford, Hertfordshire. England.

Telephone Watford 21297.
Cables Dymar Watford.
Telex 923035.

1. GENERAL DESCRIPTION

The Dymar Radio Frequency Power Meter Type 1581 is a direct-reading absorption Wattmeter with a wide power measuring range from 30 mW to 100 W. This makes it eminently suitable for testing transmitters of portable, mobile or base radiotelephone equipment in the HF, VHF and UHF bands.

The sensing elements are UHF thermocouples which ensure that the "true" power is measured, irrespective of the harmonic or sideband content of the wave-form.

The meter has large linear scales in 1 - 3 - 10 sequence which allows easy and accurate reading.

The coaxial load is oil-cooled, and gives a good V.S.W.R. up to 500 MHz. The load impedance is 50 ohms.

The instrument is operated from A.C. mains or from its own rechargeable batteries, and as such it is equally suitable as a laboratory instrument or as a portable service instrument for field use.

2. SPECIFICATION.

Power Ranges:	Six ranges with full scale readings as follows: 300 mW, 1W, 3W, 10W, 30W, 100W.
Frequency Range:	D. C. - 500 MHz.
Accuracy:	5% of f. s. d. from D. C. - 200 MHz. 10% of f. s. d. from 200 MHz - 500 MHz.
Input Impedance:	50 ohms.
V. S. W. R.	1 : 1. 1 up to 200 MHz 1 : 1. 3 200 MHz - 500 MHz.
Load Rating:	The continuous dissipation in the load should not exceed 50 Watts. 100 Watts should not be applied for more than 15 minutes in any 30 minute period.
External Power Supply:	190 - 260 Volts 95 - 130 Volts 50-60 Hz. or 22-32 Volts DC at 30 mA.
Internal Battery:	24 Volt (nominal) Nickel Cadmium rechargeable battery of 400 mAh capacity, giving a typical operating time of 13 hours between recharging. Batteries can be recharged internally through a built-

in charging circuit in 14 hours from a fully discharged condition (22 Volts).

Meter:

Precision 5 inch movement with mirror-backed scale calibrated 0 - 10 and 0 - 3. A "check battery" push button connects the meter across the battery to read voltage directly.

Dimensions and Weight:

Width	Height	Depth	Weight
$16\frac{1}{2}$	$6\frac{1}{2}$"	8"	13 lb
42 cm	16.5cm	20cm	6 kg

Accessories:

Rack Mounting Adaptor Kit Type 1801.
Protective Front Panel Cover Type 1802.

Typical figures based on normal operating conditions.

Dymar policy is one of continuous improvement, therefore the right is reserved to change specifications without notice.

3. OPERATION.

3.1. Power Supply.

The instrument as despatched from the factory is normally set for 230 V operation, and no further tap changes or adjustments are necessary, provided the mains voltage is between 190 and 260 Volts A.C. If the mains voltage is in the range 95 to 130 Volts A.C. then the primary windings on the transformer have to be connected in parallel and not in series. In order to do this, remove the cover from the instrument, and make the following adjustments on the power supply board which is situated behind the meter. Remove the link which connects the two pins marked 230 V, and substitute it with two links across pins marked 115 V. Also replace the 150 mA fuse with an equivalent type but rated for 300 mA.

To operate the instrument from the mains supply, push the red button marked "Mains" which will then light up.

To operate the instrument from its own internal battery, first check the battery voltage by depressing the green button, when a reading of not less than 22 Volt on the 30 Volt scale should be obtained, and then push in the blue button only. This button does not light up, in the interest of conserving battery drain, but the instrument is nevertheless operational. If the battery voltage is less than 22 Volts, the batteries need recharging. This is done by depressing both red and blue buttons, when the instrument is operational from the mains and charging its own batteries simultaneously. A discharged battery of 22 Volts or less will take 14 hours of charging to obtain its full charge.

To operate the instrument from an external battery, connect it to the two sockets at the back, and push the slider switch to "External Battery", and then proceed as before. The battery should have a nominal voltage of 24 Volts, and the instrument will operate satisfactorily between 22 and 32 Volts D.C.

3.2.

Switch on the supply. Using the 'Zero' control on the front panel, adjust for minimum deflection on the meter when the "Range" switch is in the most sensitive position, i.e. 0.3 Watts. The residual reading from noise should be less than 3 divisions on the upper scale. Apply the power to be measured to the input socket, and select with the "Range" switch the appropriate range to obtain a reading.

4. TECHNICAL DESCRIPTION.

The Thermocouple Wattmeter consists basically of a 50-ohm resistor with facility for R. F. signal sample, an R. F. detector whose output is D. C., a D. C. to A. C. convertor, an A. C. amplifier, an A. C. to D. C. convertor, and a meter.

The 50-ohm absorption load consists of a carbon film deposited on a ceramic tube resistor enclosed in a copper coaxial cavity which is oil filled. A copper bellows is fitted to the rear of the coaxial cavity to allow for expansion of the oil at high powers. The resistor has a pick-off ring approximately 3 ohms from the earth end. A series 47 ohm resistor is fitted to match the output coax of the load.

The R. F. circuitry (see circuit diagram A1-102280) functions in the following manner. When the "Range" switch is in the 0.3, 1 or 3 Watts position, the R. F. coaxial relay, RL1, has its wiper connected to the output of Attenuator 1. At an input to the 50 ohm load of 3 Watts, approximately 2. 5 mA RMS current passes through the heating element of the thermocouple THC1. The thermocouple element applies a small D. C. voltage, proportional to the temperature of the heating element. Attenuator 2 and thermocouple THC2 are switched into circuit when 10, 30 or 100 Watts are selected.

The reed of the chopper is resonant at approximately 100 Hz, the driving coil being energised by multivibrator TR1, TR2 and associated components. The output from the chopper is thus a 100 Hz square wave, of peak-to-peak voltage equal to the D. C. output of the thermocouple.

TR3, TR4 and associated components make up an amplifier with a gain of approximately 25, the output of which is applied to the "Range"switch attenuator. Resistors R26 to R31 are pre-settable, each being adjusted to give full-scale deflection on the meter for the appropriate input power. Transistors TR5, 6, 7, 8 and 9 make up an emitter follower and two feedback amplifiers. The output of TR9 is full wave rectified by diodes D2 and D3, giving a balanced D.C. output which is applied via the plug PL1 and socket SK1 to the meter circuitry.

The design of the power supply is conventional, and consists of Transformer T1 and rectifying diodes D3 and D4 giving "raw" D.C. across capacitor C7. This voltage is an unregulated 24 Volts and is applied to the regulator which gives a highly stable voltage of 12.6 V at Pin 1 of SK1. The reference voltage is the Zener Diode D1, and the difference amplifier is VT3 and VT4. RV1 adjusts the voltage to 12.6 Volts precisely. The series element of the regulator is VT1 driven by the emitter follower VT2. The collector load of VT4 is returned to a stabilised voltage of about 18V (5.6V relative to 12.6V) from across Zener Diode D2, and this voltage is applied to series transistor VT5, giving a partially stabilised voltage of 18 Volts at Pin 2.

The same regulator is used to stabilise the voltage of the internal (or external) battery of 24 Volts if used.

The internal battery is re-charged by the voltage doubling circuit of D5, D6, C5 and C6 through Resistor R9.

5. ALIGNMENT PROCEDURE.

5.1

If re-alignment of the instrument is required, withdraw the right-hand, or "Plug-In" part of it, by releasing the two Phillips-type screws on the back panel.

All test points and pre-set controls are now accessible for adjustment. Do not adjust or tamper with these controls unless adequate test gear is available for the proper calibration of the instrument.

5.2 The following test gear are required:

1. A stabilised D.C. power source.
2. A digital voltmeter with 0.2% accuracy.
3. A resistance bridge with at least ± 1% accuracy.
4. A high-power R.F. oscillator covering the range 150 - 500 MHz.
5. V.H.F. Millivoltmeter with T-connector (Dymar Type 1711).
6. An R.F. admittance bridge for measuring V.S.W.R. in the range 150 MHz - 500 MHz.

5.3 Checking of V.S W.R.

Connect the Power Meter through the type "N" socket SK1 to the admittance bridge, and check the V.S.W.R. over the whole of the frequency range between 150 MHz and 500 MHz, and note if it meets the required specification.

5.4 Calibration of Power Ranges

Measure the R.F. load, R55, on the resistance bridge. Calculate the appropriate D.C.

voltages to be applied to all six ranges for full-scale deflection ($WR = V^2$). Set R20 to approximately mid-position. This pre-set determines the overall gain of the amplifier TR3 and TR4. Turn the "Range" switch to 0.3W, switch "ON" the power supply of the R.F. Power Meter and set the "Set Zero" potentiometer for minimum deflection (three divisions on the upper scale maximum).

Connect D.C. supply to the input socket SK1 and monitor the voltage by means of the digital voltmeter. Adjust the voltage level to the value calculated for that range. By means of R26, set the meter reading to 0.3 Watts.

Similarly, adjust 1W range by means of pre-set R27, 3W range by pre-set R28, 10W range by pre-set R29, 30W range by pre-set R30, and 100W range by pre-set R31.

5.5 Checking the Frequency Response

Apply to the input socket SK1 a calibrated R.F. voltage from the power oscillator at 150 MHz, and using this reading on the voltmeter as reference, check that meter indication of the R.F. Power Meter is within the specified accuracy up to 500 MHz.

6. COMPONENTS LIST.

Circuit Ref.	Description	Value	Tol. %	Rating
R1	Carbon	1K	5%	½W
R2	Pot. Carbon Lin.	1K		
R3	Carbon	3.3K	5%	½W
R8	Pre-set	10K		
R9	Carbon	12K	5%	½W
R10	Carbon	1.5K	5%	½W
R11	Carbon	1.5K	5%	½W
R12	Carbon	1.5K	5%	½W
R13	Carbon	12K	5%	½W
R14	Carbon	18	5%	½W
R15	Carbon	470	5%	½W
R16	Carbon	4.7K	5%	½W
R17	Carbon	10K	5%	½W
R18	Carbon	330	5%	½W
R19	Carbon	8.2K	5%	½W
R20	Pre-set	10K		
R21	Carbon	18K	5%	½W
R22	Carbon	270	5%	½W
R23	Carbon	3.9K	5%	½W
R24	Carbon	3.9K	5%	½W
R25	Carbon	10K	5%	½W
R26	Pre-set	22K		
R27	Pre-set	4.7K		

Circuit Ref.	Description	Value	Tol. %	Rating
R28	Pre-set	1K		
R29	Pre-set	22K		
R30	Pre-set	4.7K		
R31	Pre-set	1K		
R32	Carbon	100K	5%	½W
R33	Carbon	100K	5%	½W
R34	Carbon	8.2K	5%	½W
R35	Carbon	4.7K	5%	½W
R36	Carbon	10K	5%	½W
R37	Carbon	330	5%	½W
R38	Carbon	22K	5%	½W
R39	Carbon	18K	5%	½W
R40	Carbon	270	5%	½W
R41	Carbon	3.9K	5%	½W
R42	Carbon	3.9K	5%	½W
R43	Carbon	4.7K	5%	½W
R44	Carbon	18K	5%	½W
R45	Carbon	10K	5%	½W
R46	Carbon	330	5%	½W
R47	Carbon	270	5%	½W
R48	Carbon	3.9K	5%	½W
R49	Carbon	3.9K	5%	½W
R50	Carbon	180K	5%	½W
R51	Carbon	10K	5%	½W
R52	Carbon	3.3K	5%	½W

Circuit Ref.	Description	Value	Tol. %	Rating
R53	Carbon	100	5%	$\frac{1}{2}$W
R54	Carbon	1K	5%	$\frac{1}{2}$W
R55	Welwyn 1609B	50	5%	12W
R56	Carbon	18	5%	$\frac{1}{2}$W
R57	Carbon	82	5%	$\frac{1}{2}$W
R58	Carbon	18	5%	$\frac{1}{2}$W
R59	Carbon	82	5%	$\frac{1}{2}$W
R60	Carbon	18	5%	$\frac{1}{2}$W
R61	Carbon	33	5%	$\frac{1}{2}$W
R62	Carbon	47	5%	$\frac{1}{2}$W
R63	Carbon	47	5%	$\frac{1}{2}$W
R64	Carbon	33	5%	$\frac{1}{2}$W
R65	Carbon	39	5%	$\frac{1}{2}$W
R66	Carbon	39	5%	$\frac{1}{2}$W
R67	Carbon	39	5%	$\frac{1}{2}$W
R68	Carbon	47	5%	$\frac{1}{2}$W
Capacitors				
C1	Metallised Film	0.68 μF	10%	63V
C2	Ceramic	1000pF	20%	
C3	Metallised Film	0.68 μF	10%	63V
C4	Tantalum	22 μF	10%	16V
C5	Electrolytic	2200 μF		25V
C6	Electrolytic	100 μF		10V

Circuit Ref.	Description	Value	Tol. %	Rating
C7	Ceramic	0.01 µF		25V
C8	Electrolytic	100 µF		10V
C9	Electrolytic	100 µF		10V
C10	Tantalum	22 µF	10%	16V
C11	Electrolytic	220 µF		25V
C12	Electrolytic	100 µF		10V
C13	Ceramic	5000pF		25V
C14	Tantalum	22 µF		15V
C15	Tantalum	22 µF		15V
C16	Electrolytic	220 µF		25V
C17	Tantalum	22 µF		15V
C18	Metallised Film	1 µF	10%	63V
C19	Metallised Film	1 µF	10%	63V
C20	Tantalum	100 µF	10%	3V
C21	Ceramic	470pf	20%	
C22	Ceramic	1000pf	20%	
C23	Ceramic	1000pF	20%	
C24	Ceramic	1000pF	20%	

Transistors

Circuit Ref.	Maker	Type
TR1	Mullard	BC107
TR2	Mullard	BC107
TR3	Mullard	BC107
TR4	Mullard	BC107

Circuit Ref.	Maker	Type
TR5	Mullard	BC107
TR6	Mullard	BC107
TR7	Mullard	BC107
TR8	Mullard	BC107
TR9	Mullard	BC107

Diodes

D1	Mullard	IN916
D2	Mullard	IN916
D3	Mullard	IN916
D4	Mullard	IN916

Miscellaneous

TH1	Thermocouple Miniature UHF
TH2	Thermocouple Miniature UHF
SW1	Range Switch 1 pole 12 ways
RL1	R.F. Relay
PL1	Plug
SK1	Output Socket N Type
CH1	Synchronous Chopper
6.1	Power Supply

Resistors

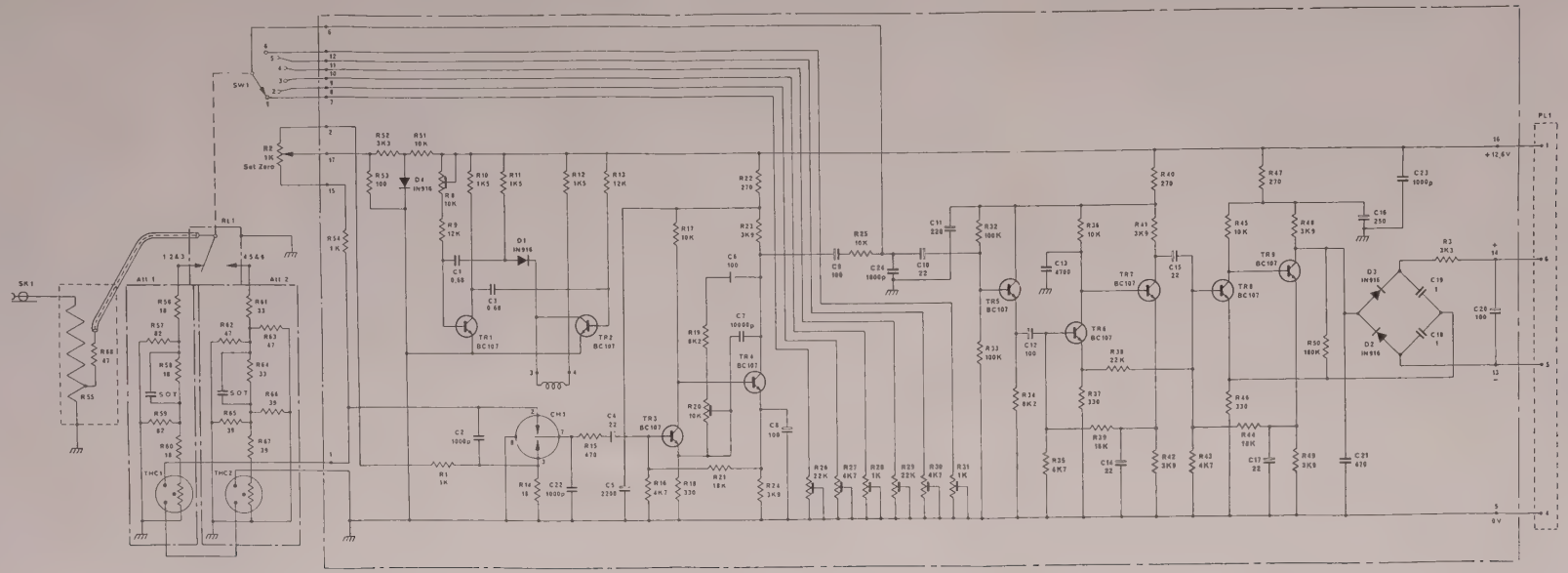
Circuit Ref.	Description	Value	Tol. %	Rating
R1	Metal Oxide	316K	1%	$\frac{1}{2}$W
R2	Carbon	2.2K	10%	$\frac{1}{2}$W
R3	Carbon	22K	10%	$\frac{1}{2}$W
R4	Carbon	4.7K	10%	$\frac{1}{2}$W

Circuit Ref.	Description	Value	Tol. %	Rating
6.1	Power Supply Cont'd)			
Resistors				
R5	Carbon	2.2K	10%	$\frac{1}{2}$W
R6	Carbon	10K	10%	$\frac{1}{2}$W
R7	Carbon	10K	10%	$\frac{1}{2}$W
R8	Carbon	10K	10%	$\frac{1}{2}$W
R9	Metal Oxide	820	5%	10W
RV1	Pre-set	2.5K		
Capacitors				
C1	Ceramic	.033 μF		25V
C2	Electrolytic	10 μF		16V
C3	Electrolytic	10 μF		16V
C4	Electrolytic	100 μF		40V
C5	Electrolytic	150 μF		100V
C6	Electrolytic	150 μF		100V
C7	Electrolytic	1000 μF		40V

Transistors

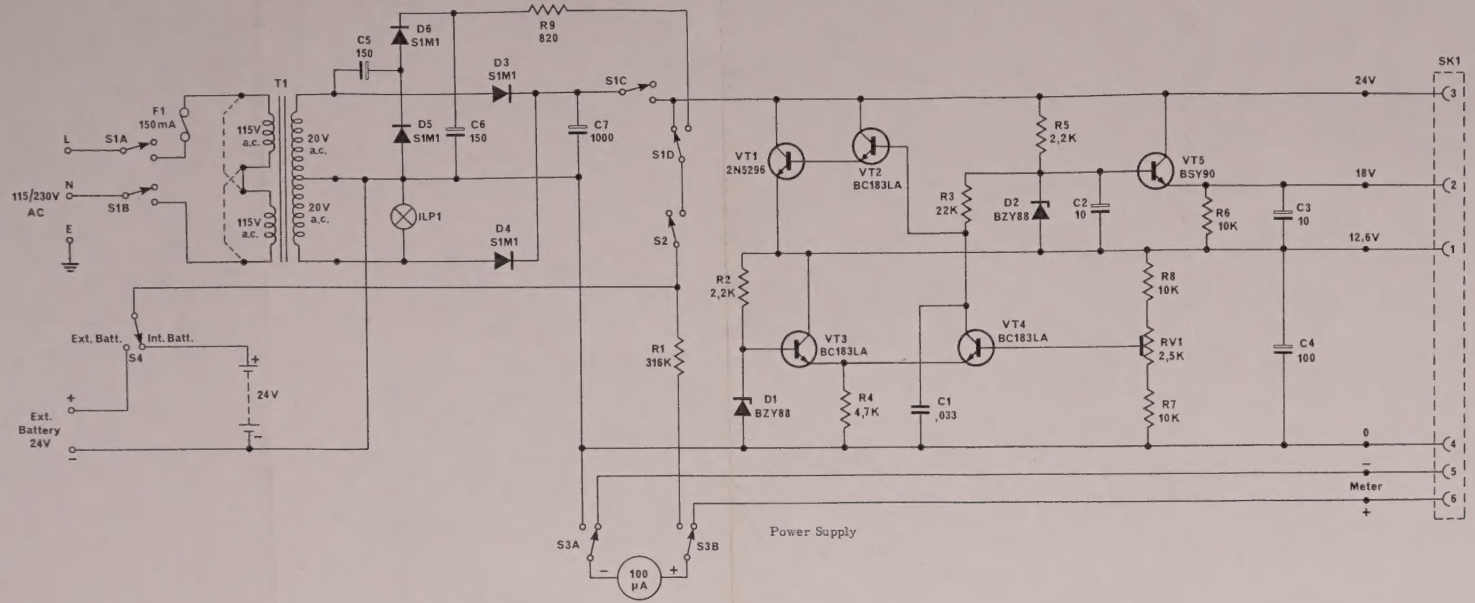
Circuit Ref.	Maker	Type
VT1	R.C.A.	2N5296
VT1	Texas	BC183LA
VT3	Texas	BC183LA
VT4	Texas	BC183LA
VT5	R C.A.	BSY90

Circuit Ref.	Description	Value	Tol. %	Rating
Diodes				
D1	Mullard	BZY88-C6V2		
D2	Mullard	BZY88-C6V2		
D3	Westinghouse	SIMI		
D4	Westinghouse	SIMI		
D5	Westinghouse	SIMI		
D6	Westinghouse	SIMI		
Miscellaneous				
Description				
T1	Transformer 40/1024			
F1	Fuse	F286		150mA
S1	Combined Push-Button Switch Special			
S2	Combined Push-Button Switch Special			
S3	Combined Push-Button Switch Special			
S4	Slider Switch D. P. D. T. Diamond H Type 278			
SK1	Socket McMurdo PS 6			
ME1	Meter Drg. No. A3-101712			



Circuit Diagram For
RF Power Meter Type 1581

AQ-102280


L
S1A
N
115/230V AC
S1B
E
F1 150mA
T1
115V a.c.
115V a.c.
20V a.c.
20V a.c.
C5 150
D6 S1M1
D5 S1M1
C6 150
ILP1
D3 S1M1
D4 S1M1
C7 1000
R9 820
S1C
S1D
S2
R1 316K
Ext. Batt.
Int. Batt.
S4
24V
Ext. Battery 24V
S3A
S3B
100 µA
Power Supply
VT1 2N5296
VT2 BC183LA
R3 22K
R5 2,2K
D2 BZY88
C2 10
VT5 BSY90
R6 10K
C3 10
R2 2,2K
VT3 BC183LA
VT4 BC183LA
R8 10K
RV1 2,5K
C4 100
D1 BZY88
R4 4,7K
C1 ,033
R7 10K
SK1
24V
18V
12,6V
0
Meter

ORE AND DISPLAY

ned in conjunction with that of the arithmetic unit. The main store,
grams and is the heart of the digital section.

rconnection and the type of signals involved, it is not normally
ugh this section. The paths shown must therefore be regarded as
ircuits and not actual connections. The purpose of the diagram is
pcb involved rather than the faulty component.

ins all the numerical data used and displayed in the 1170. A com-
he instructions for the use of the Store State Indicator. (special